

and anal aperture besides. But it must be borne in mind that the anus in the Polyzoan does not open at the extremity of the body opposite the mouth, as in the archetypal Mollusc, but, by a sudden bend of the intestine, the anal aperture is brought into the closest possible proximity to the mouth, so that, although separate, they both open at the same spot. And let it not be supposed that this detracts aught from their position as Molluscs; for in the highest Molluscs, viz. the Cephalopods, the same thing takes place in a somewhat less degree. Here, again, is a structure which implies great *community of general habit*. Lastly, there is another most important community of habit between the Polypes and Polyzoa, viz. that, although the Mollusca as a class are oviparous, the Polyzoan Molluscs are, in addition, *gemmiparous*, like the Polypes; and this power is evidently the secret of the production of those compound forms which the Polyzoa present in common with Polypes. Hence we see that, with scarcely anything in common except superficial characters, the habits of Polyzoa and Polypes are nearly identical; and to this fact I would look for an explanation of their identity of form.

XV.—*Observations on two new species of Chiton from the Upper Silurian 'Wenlock Limestone' of Dudley.* By M. L. DE KONINCK, Member of the Royal Academy of Sciences, Belgium, &c.*

[With a Plate.]

ON my last visit to England I had the opportunity of studying a great number of new fossils, forming part of the magnificent collection of Mr. John Gray of Hagley, amongst which I observed two species of *Chiton*, obtained from the Upper Silurian beds of the neighbourhood.

Before entering into a detailed description of these species, it would perhaps be useful to give a *résumé* of the palæontological works which treat of species of a similar character to those forming the subject of these observations.

GENUS CHITON, Linn.

Established by Linnæus in 1758 for a small number of living species, this genus for a long time had no representative amongst fossils.

It was not until the year 1802 that the first species of fossil

* Translated by W. H. Baily, F. G. S., Acting Palæontologist to the Geological Survey of Ireland, from the 'Bulletin de l'Académie Royale des Sciences, etc. de Belgique,' 26^{me} année, 2^{me} sér., t. iii. 1857.

Chiton was discovered by DeFrance, and described by Lamarck* under the name of *Chiton grignonensis*, that name being derived from a locality long celebrated for the great number of fossils found there in deposits belonging to the Calcaire grossier of Paris, that is to say, to the middle beds of the Tertiary formation.

In 1834 M. Conrad made known a species (*C. antiquus*) from the Tertiary formation of Alabama†.

In 1836 M. Puzos and M. le Comte Duchastel‡ found some remains of *Chiton* in the Carboniferous formation of the environs of Tournay; these fragments enabled Count Münster to establish a new species, which he described and figured in 1859§ under the name of *Chiton priscus*.

This discovery was considered of some importance by palæontologists, who were far from expecting to find species of this kind in palæozoic strata; nevertheless, in the latter part of the year 1840, M. Guido Sandberger announced the probable existence of the genus *Chiton* in the Devonian limestone of Villmar||. In 1842 the same geologist added two new species, under the names of *C. subgranosus* and *C. fasciatus*, to the list which he then published of Devonian fossils from the same locality¶; one of these species is probably identical with that which M. F. Roemer has mistaken for *Bellerophon expansus*, Sow.**, and which was named *C. cordiformis* by M. Sandberger in 1845.

In 1843 I described three new species of *Chiton*††, procured from the Carboniferous formation of Belgium, to which in 1845 M. le Baron de Ryckholt added some others discovered by himself in the same formation‡‡. That *savant* made known at the same time the existence of a *Chiton* from the Tertiary formation of Italy—a species we owe to the researches of M. Cantraine, Professor in the University of Ghent; it is described by him under the name of *C. subapenninus* in the second part of the ‘Malacologie Méditerranéenne et Littorale.’ It may, however, prove identical with that from near Turin, published in 1847 by M. Michelotti under the name of *C. miocenicus* §§.

* Annales du Muséum, t. ii. p. 309.

† Morton, Syn. of Organic remains, Appendix, p. 6.

‡ This species is published by M. Deshayes in the new edition of the ‘Histoire nat. des Anim. s. Vertèbres’ of Lamarck, t. vii. p. 490.

§ Beiträge zur Petrefaktenkunde, i. p. 38.

|| Neues Jahrb. für Mineral. und Geol. 1841, p. 240.

¶ Ibid. 1842, p. 399. These names were replaced in 1853 by those of *C. corrugatus* and *sagittalis*, without M. Sandberger having given a reason for so doing (G. & F. Sandberger, ‘Die Versteiner. des Rhein. Schichtens. in Nassau,’ pp. 238, 239).

** Neues Jahrb. für Mineral. und Geol. 1845, p. 439.

†† Descript. des anim. fossiles du terr. carb. pp. 322, etc.

‡‡ Bulletins de l’Académ. de Belg. t. xii. 2^{me} partie, pp. 45, etc.

§§ Descript. des foss. du terr. mioc. de l’Italie, p. 132, pl. 16. f. 7.

Before the publication of the work of M. de Ryckholt, Mr. King had already announced the occurrence of a *Chiton* found by Mr. Loftus in the Permian formation near Sunderland*, and described later under the name of *C. Loftusianus*†,—on this side, M. Philippi having made known two other species (*C. siculus*, Gray, and *C. fascicularis*, Linn.) from the tertiary strata of Sicily‡.

After these discoveries, Mr. Salter in 1846 added another and much more remarkable example, that of a species of *Chiton* from the lower beds of the Silurian strata of Ireland. That author proposed on the occasion a new genus, under the name of *Helminthochiton*, for the purpose of receiving the palæozoic species§; but as it is not distinguished by any essential character from the ordinary genus *Chiton*, it can merely serve to denote a section of that genus.

In 1848 Mr. Searles Wood described and figured, in his magnificent Monograph on the Mollusca from the Crag of England, three fossil species of *Chiton*, one of them being new (*C. strigilatus*), and the two others identical with species living in our seas at the present day (viz. *C. fascicularis*, Linn., and *C. Rissoi*, Payr.||).

About the same date M. Eudes Deslongchamps, to whom science is indebted for a great number of excellent works on the Jurassic fossils of the environs of Caen, discovered in the Bathonian beds of Iangrunc the posterior or anal plate of a species of *Chiton*, which he obligingly dedicated to me¶—this being the first discovery of the genus in Secondary strata, although their probable existence in strata of that age was some time before predicted by him**.

In 1852, M. Terquem added a new link to the chain uniting the palæozoic Chitons to those of the present epoch, by the discovery of a new species (*C. Deshayesii*) in the middle Lias of Thionville††.

Finally, M. F. A. Roemer described and figured in 1855 a new

* Ann. & Mag. of Nat. Hist. 1844, vol. xiv. p. 381.

† Monogr. of the Permian Foss. of England, Pal. Soc. 1849, p. 202.

‡ Enumeratio Mollusc. Sicil. t. ii. p. 85.

§ Synopsis of the Silur. foss. of Ireland by Sir R. Griffiths, p. 74; and Quarterly Journ. of Geol. Soc. of London, vol. iii. pp. 48, &c.

|| Monog. of the Crag Mollusca, pt. 1. pp. 185, &c. Besides these three species, Mr. Wood had also announced three others, which he considered to be new, in his Catalogue of Crag Mollusca published in 1842 (Ann. & Mag. of Nat. Hist. vol. ix. p. 460); but these he appears to have since abandoned.

¶ Mém. de la Soc. Linn. de Normandie, t. viii. pp. 156, &c.

** Descript. des Anim. foss. du terr. carb., p. 321.

†† Bullet. de la Soc. Geol. de France, 2^{me} sér. t. ix. pp. 386, etc.

species of Chiton (*C. lævigatus**), obtained from the upper part of the Devonian strata near Grund, and figured another to which he did not give a name, but which I propose to designate under that of *C. tumidus*†.

The following is a list of all the species of fossil Chitons known up to the present time, with an indication of the geological series in which they have been observed, and the locality from which they were obtained ‡:—

Upper Tertiary.

1. Chiton siculus, Gray. Sicily.
2. — fascicularis, Linn. Sicily; Sutton.
3. — Rissoi, Payraudeau. Sutton.
4. — strigillatus, Wood. Sutton.
5. — { miocenicus, Michelotti. Turin.
 { subapenninus, Cantr.?
6. — subcajetanus, Poli (ex fide D'Orb.). Turin.
7. — transenna, Lea. Virginia.

Lower Tertiary.

8. Chiton antiquus, Conrad. Alabama.
9. — grignonensis, Lamk. Grignon.

Great Oolite or Bathonian.

10. Chiton Koninckii, Eudes Deslongch. Langrune.

Lias.

11. Chiton Deshayesii, Terquem. Thionville.

Trias.

12. Chiton? Cottai, Geinitz. Bunter Sandstone.
13. —, sp. §

Permian.

14. Chiton Loftusianus, King. Durham.
15. — Howseanus, Kirkby. Durham ||.

* W. Dunker und H. v. Meyer, Palæontographica, t. v. p. 36, pl. 7. fig. 8 a, b.

† Ibid. pl. 7. fig. 9 a, b.

‡ To this list of M. De Koninek's I have added others since discovered, so as to make it complete up to the present time.—W. H. B.

§ When at the Aberdeen meeting of the British Association in September 1859, I was shown by Mr. Charles Moore, of Bath, some plates of *Chiton* obtained by him, with other very interesting fossils, from the Trias formation near Frome, Somersetshire. This will therefore add an additional species to the doubtful one included in the above list.—W. H. B.

|| In 1856 this Permian species was discovered at Tunstall and Humbleton Hill, Durham, and was described in 1857 by Mr. J. W. Kirkby; in March 1859 he also described, in the 'Proceedings' of the Geological Society of London, the four following additional species. One of these he doubtfully refers to *Chiton* proper; the others he considers to belong to

16. *Chiton* ? *cordatus*, *Kirkby*. Durham.
17. *Chitonellus Hancockianus*, *Kirkby*. Durham.
18. — *distortus*, *Kirkby*. Durham.
19. — *antiquus*, *Howse*, sp. Durham.

Carboniferous Limestone.

20. *Chiton concentricus*, *De Kon.* Visé.
 21. { — *gemmatus* *, *De Kon.* Visé.
 — —, var. *mosensis*, *De Ryckh.*
 — —, *Viseticola*, *De Ryckh.*
 — —, *legiacus*, *De Ryckh.*
 — —, *eburonicus*, *De Ryckh.*
 22. *Chiton priscus*, *Münster.* Tournay.
 23. — *nervicanus*, *De Ryckh.* Tournay.
 24. — *turnacianus*, *De Ryckh.* Tournay.
 25. — *Mempiscus*, *De Ryckh.* Tournay.
 26. — (*Chitonellus*), *cordifer*, *De Kon.* Tournay.
 27. — *thomondiensis* †, *Baily.* County of Limerick.
 28. — *Burrowianus* ‡, *Kirkby.* Settle, Yorkshire.
- And probably three or four other species from that locality.

Upper Devonian.

29. *Chiton lævigatus*, *Fr. Ad. Roemer.* Grund.
30. — *tumidus*, *De Kon.* Grund.

Middle Devonian.

31. { *Chiton corrugatus*, *G. & F. Sandberger.* Villmar.
 — *cordiformis*, *G. Sandberger.*
 — *priscus*, *G. Sandberger* ; non *Münster.*
 — *Sandbergianus*, *De Ryckh.*
32. *Chiton sagittalis*, *G. & F. Sandberger.* Villmar.
 —, n. sp. Plymouth (Geol. Surv. Collection).

the genus *Chitonellus* ; the one he calls *Chitonellus antiquus*, having previously been mistaken by Mr. Howse for a *Calyptæa*, was named by him *Calyptæa antiqua*.—W. H. B.

* M. A. d'Orbigny, in his 'Prodrome de Paléontologie,' t. i. p. 127, has proposed to change this name into that of *subgemmatus*, under the idea that there already exists a *Chiton* of that name, described in 1825 by M. De Blainville. This, however, is an error.—L. De K.

† In April 1859 I made known, in a paper read before the Geological Society of Dublin, the discovery of the plates of a *Chiton* of larger dimensions than any previously met with (plates belonging to several individuals were obtained), from the Carboniferous Limestone of Lisbane ; since then I myself collected other plates of a similar species in a cutting at Rathkeale, on the Limerick and Foynes Railway. This species I described by the above name of *Chiton thomondiensis* (vide Journ. of the Geol. Soc. Dublin, vol. viii. pt. 2. p. 167).—W. H. B.

‡ In a note to Mr. Kirkby's paper (Journ. of the Geol. Soc. of London, vol. xv. p. 610), and a further communication with which I was favoured by him, he mentions the fact of an additional discovery by Mr. J. H. Burrow, of an interesting series of plates of *Chitons* from the Carboniferous or Lower Scar Limestone of Settle in Yorkshire. These plates he believes to belong to five species, which he could not identify with any of the Belgian species described by Baron Ryckholt and Professor De Koninck ; one of them he has named *Chiton Burrowianus*, after the discoverer.—W. H. B.

Upper Silurian.

33. Chiton Grayanus, *De Kon.* Wenlock Limestone, Dudley.
 34. — Wrightianus, *De Kon.* " " "

Lower Silurian.

35. Chiton (Helminthochiton) Griffithii, *Salter.* Cong. co. Galway.

On an inspection of this list the result is, that, notwithstanding the number is relatively small when compared with that of recent species, the existing genus *Chiton* is represented in almost all the series of sedimentary rocks, and that hitherto the Cretaceous and Triassic are the only formations in which there have not been discovered any traces*. I have no doubt that this gap will soon be filled, as it is not very probable that these animals, whose appearance on our globe dates so far back in geological time as the Lower Silurian, continuing through all the other formations up to the present day, should have been unrepresented in these two geological periods. The same list, again, demonstrates that, after the Tertiary, it is the Carboniferous strata which contain the greatest number of species, and that it is the intermediate strata which have furnished the fewest †.

I shall now proceed to give descriptions of the two new species of *Chiton* which form the principal subject of this notice. With the specimens of one I have been aided by Mr. John Gray of Hagley, by whom it was discovered, and of the other by Dr. Thomas Wright of Cheltenham, well known for his investigations upon the fossil Echinoderms of Great Britain.

1. *Chiton Grayanus*, De Koninck. (Pl. II. fig. 1 *a, b, c, d.*)

The dorsal cerames, or intermediate plates of this species, which are the only ones with which I am acquainted, are formed of two lateral parts, perfectly plane, of a nearly square form, and united together by an angle a little more than a right angle. The dorsal carina is most developed; the anterior part of each plate is slightly crenated; the test appears to have been very

* Mr. Charles Moore's discovery of Triassic Chitons in British strata was made since the publication of Professor De Koninck's paper. See note § on page 94.

† While this article was in the press, Mr. Charles Moore has favoured me with the additional information of his having found examples of the genus *Chiton* in the following formations in England, in which they had not hitherto been observed, viz. :—

Bradford Clay; Hampton, near Bath: a single plate.

Upper Lias; near Ilminster: about a dozen separate plates, all belonging to one species.

And in the Triassic beds near Frome, before alluded to, where the plates of a small and not uncommon species occur.—W. H. B.

thin. Their external surface is ornamented by a very great number of fine parallel striæ or lines of growth; on the lateral and anterior sides of each plate, and between them, there are extremely thin ribs covered with small granulations. Each of these plates appears to have undergone a suspension of development at about the middle of its growth; this interruption is indicated by a striation much larger and deeper than the others, which are all nearly equal in strength. The median and lateral areas are very nearly equal, and divide each side of the plate into two parts.

It is probable that, if this species was furnished with apophyses, they were very small, as I have not been able to discover any trace of them on the various specimens I had the opportunity of examining.

Relations and Differences.—This *Chiton* presents a greater similarity with *C. priscus*, Munster, and *C. Mempiscus*, De Ryckh. It differs from both, however, by the lateral margin of its plates being more even, by the slight thickness of its test, by the absence of apophyses, and especially by the fineness and great number of striæ covering its surface.

Dimensions.—Length of the dorsal plate about 12 millimetres; breadth of each side 10 mm., which gives for the complete animal an approximate length of from 80 to 90 millimetres, and a mean breadth of 16 to 18 mm.

Locality.—This species has been discovered by Messrs. Gray and Fletcher in the Upper Silurian 'Wenlock limestone,' near Dudley.

2. *Chiton Wrightianus*, De Koninck. (Pl. II. fig. 2 a, b, c.)

The form of the dorsal plates of this species is subtriangular, the posterior edges making very nearly a right angle. The lateral angles are rounded, and the anterior edge is very sinuous. All the plates are supplied with a well-marked median carina, and appear to have been without apophyses. The surface is covered with a small number of deep equidistant striæ. The test is slender. The median area is larger than the lateral one.

Relations and Differences.—This *Chiton* very much resembles *C. Loftusianus*, King, but differs from it in the regularity of the striæ of the median and lateral areas, and by the more marked sinuosity of the anterior edge of its plates.

Dimensions.—The length of each dorsal plate is about 8 millimetres, and the breadth 12 mm.

Locality.—This species was found by Mr. Gray with the preceding one; it is, however, scarcer than even that.

EXPLANATION OF PLATE II.

Fig. 1 a, *Chiton Grayanus*, De Kon., nat. size, with fragments of four
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dorsal plates, from the collection of Mr. Gray; 1 *b*, a plate, seen from the anterior side; 1 *c*, half plate, enlarged; 1 *d*, complete specimen, hypothetically restored and slightly enlarged.

Fig. 2 *a*, *Chiton Wrightianus*, De Kon., nat. size, showing two dorsal plates compressed; 2 *b*, dorsal plate, seen on the posterior side; 2 *c*, restored specimen, taking as a base the *Chiton Loftusianus*.

XVI.—Notes on the Subgenus *Corilla*, H. & A. Adams; and on the Group *Plectopylis*, Benson; also on *Pollicaria*, Gould, and *Hybocystis*, Benson. By W. H. BENSON, Esq.

WITH reference to the group *Plectopylis*, published in the 'Annals' for April last, I have received from Mr. Augustus A. Gould of Boston, U.S., a sheet containing 'Shells of the North Pacific Exploring Expedition,' with a proposed amended description of Messrs. H. and A. Adams's subgenus *Corilla*.

"Subgen. *Corilla*, H. & A. Adams (emendatum).—Testa planorboidea, plerumque sinistrorsa, plus minusve distorta, arete spirata, subtus concava; fauce in fundo denticulis compressis fere ocluso, quorum uno sæpe ad aperturam producto; peristomate incrassato, reflexo."

Mr. Gould adds a new species from Hong Kong, *C. pulvinaris*, G., with "denticulis in fauce ad 9, haud productis" among the characters of the aperture. This shell he states to be "almost precisely of the size and shape of *H. refuga*, Gould; but that is reversed, and has a lamina running to the aperture."

Mr. Gould informs me that in a more extended paper he has gone more fully into individual peculiarities. This was published, he further states, in 1859. I have not had the good fortune to meet with it; and for more than six months have been in vain endeavouring to get a copy of a paper on Siamese shells, published several years earlier at Boston.

Now the subgeneric character, "fauce in fundo denticulis compressis fere ocluso," seems to provide for the retention of *Helix Rivolii* and *H. erronea*, which the characters of *Plectopylis* absolutely exclude from my group, and leave in Messrs. Adams's original subgenus *Corilla*, as they are furnished only with spiral lamellæ, and have no pylæic barrier. On the other hand, the character "planorboidea" would ignore *H. plectostoma* and *H. Pinacis*, in which the pylæic barrier is present.

Messrs. Adams's typical species of *Corilla* are *H. Rivolii* and its congeners; and *Helix plectostoma* had been referred to a distinct group. *Plectopylis* was designed to unite shells previously referred to different subgenera (although allied by the presence of pylæic barriers), and to separate species destitute of